Networking at the Edge

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Ubiquitous == Distributed

- Computers are already ubiquitous

  – Microwave ovens

  – Watches

  – Automobiles

- What really makes ubiquitous computing is connection and
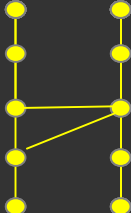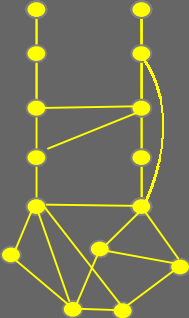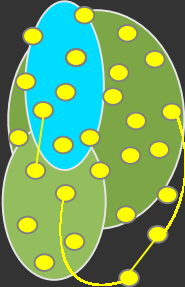
- interaction

Networks are Changing

- Today's networks are

  – Larger

  – More heterogenious

  – More important

- The trend will continue

- People will not be in the loop

Platform Evolution

	Client-Server	3/N-Tier	Net Apps	Net Services	Next	After that
Catch Phrase	The Network Is the computer	Objects	Legacy to the Web	The Computer Is the Network	Networking at the Edge	Network of Things
System Collections Components						
Scale	100s	1000s	1000000s	10000000s	100000000s	1000000000s
When/Peak	1984/1987	1990/1993	1996/1999	2001/2003	1998/2004	2004/2007
Leaf Protocol(s)	X	X	+HTTP (+JVM)	+XML, Portal	+RMI	Unknown
Directory(s)	NIS, NIS+	+ CDS	+ LDAP (*)	+UDDI	+ Jini	+ ?
Session	RPC, XDR	+CORBA	+CORBA, RMI	+ SOAP, XML	+ RMI/Jini	+ ?
Schematic						

These Aren't Computers

- Things that contain computers

  – Minimal to no administration

  – Value through interoperation

  – Single function

  – Interact with each other, not people

- The network is a separate entity

  – Invisible

  – Only its absence will be noted

The Rules Will Change

- Computers are expected to
  - Be hard to use
  - Need constant care
  - Break early and often
- Things are expected to
  - Be intuitive to use
  - Take care of themselves
  - Never break

Current Techniques are Insufficient

- ## RAS is not enough

  - 99.999% is not sufficient for components

  - Network, not component, reliability

  - The only acceptable measure is 100%

- ## RAS must become RASS

  - Reliablity, Accessible, Scaleable and

  - Survivable

We Have Partial Answers

- Jini™ Networking Technology

  – Reliability through simplicity

  – Allows evolution

  – Enables self-administration

  – Designed for programs to discover programs

  – Self-healing

  – Leased resources

- Not the final answer, but a start

We Need More...

- Models allowing reasoning about

  - Power

  - End-to-end real time

  - Mobility of services and machines

  - Porosity of the interface

- We must practice reliability

  - We know how

  - We must revitalize the craft

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